ICC-ES Evaluation Report

ESR-4194

Reissued July 2019
Revised September 2019
This report is subject to renewal July 2021.

www.icc-es.org | (800) 423-6587 | (562) 699-0543 *A Subsidiary of the International Code Council®*

DIVISION: 05 00 00—METALS
Section: 05 05 23—Metal Fastenings

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 05 23—Wood, Plastic, and Composite Fastenings

REPORT HOLDER:

JAACO CORPORATION

EVALUATION SUBJECT:

POWER-ACTUATED FASTENERS FOR SHEAR WALL ASSEMBLIES WITH STEEL FRAMING AND WOOD STRUCTURAL PANELS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012 and 2009 *International Building Code®* (IBC)
- 2015, 2012 and 2009 *International Residential Code®* (IRC)

Property evaluated:

Structural

2.0 USES

Jaaco NailPro hardened ballistic fasteners are used to attach oriented strand board (OSB) wood structural panels to cold-formed steel (CFS) framing for shear wall applications under the IBC to resist in-plane wind or seismic forces; and are limited to locations not exposed to the weather or damp environment. The fasteners may also be used to attach OSB to CFS framing for general purposes, such as sheathing. The fasteners may be used in structures regulated by the IRC, when an engineered design is submitted in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 Jaaco NailPro Hardened Ballistic Fasteners:

3.1.1 General: See ESR-2961 Section 3.1.1 for knurled shank fasteners.

3.1.2 Knurled Shank Fasteners: See ESR-2961 Section 3.1.2.

3.2 Wood Structural Panels (OSB):

Wood structural panels must be Structural I, Exposure I, OSB panels complying with DOC PS-2.

3.3 Cold-formed Steel (CFS) Framing Members:

3.3.1 Shear Walls: CFS framing members must be recognized in a current ICC-ES evaluation report, and must be manufactured from steel complying with ASTM A 1003, ST Grade 33, Type H, or with ASTM A 653 SS, Grade 33 for wall studs; and ASTM A 653, SS, Grade 50 steel for wall tracks, with a minimum G60 galvanization coating designation in accordance with ASTM A 653**.**

CFS wall studs must be C-shaped members with a designation thickness of 43 mils (1.092 mm) [a minimum 0.0428-inch (1.087 mm) uncoated base-steel thickness], a minimum flange width of $1^5/_8$ inches (41.3 mm), an overall depth of $3^5/_8$ inches (92.1 mm), and a minimum flange stiffener (lip) length of $^1/_2$ inch (12.7 mm).

CFS wall tracks must be channel-shaped members with a designation thickness of 54 mils (1.372 mm) [a minimum 0.0538 inch (1.367 mm) uncoated base-steel thickness], a minimum flange width of $1^1/_2$ inches (38 mm), and an inside depth equal to the overall depth of the CFS wall studs.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 Single Fastener Connections: See ESR-2961 Section 4.1.1 and Table 1.

4.1.2 Shear Walls: The shear walls comply as Type I shear walls as set forth in Section C2 of AISI S213 and must conform to all requirements for Type I shear walls in AISI S213, except as specifically noted in this evaluation report. The maximum shear wall aspect ratio (height-to-length ratio) is 1:1. OSB panels must be installed with the long dimension perpendicular to the CFS studs and attached to the framing with the NailPro NP100K fasteners at the spacings noted in Table 1. Blocking may be used at the panel edge joints.

4.1.2.1 Wind Resistance: Allowable racking shear loads are given in Table 1 for wind forces for use with load combinations in IBC Section 1605.3.1. The shear wall deflection due to the applied shear load must be calculated using the following equations, as applicable:

$$\delta = \frac{8vL^3}{E_s A_c b} + \omega_1\omega_2\frac{vL}{\rho G t_{panel}} + \omega_1^{5/4}\omega_2\omega_3\omega_4\left(\frac{2.75v}{\beta}\right)^2 + \frac{h}{b}\delta_v$$

For **SI:**

$$\delta = \frac{2vL^3}{3E_s A_c b} + \omega_1\omega_2\frac{vL}{\rho G t_{panel}} + \omega_1^{5/4}\omega_2\omega_3(\alpha)\left(\frac{2.75v}{0.00290\beta}\right)^2 + \frac{h}{b}\delta_v$$

where:

A_c = Gross cross-sectional area of chord member, in square inches (mm^2)

b = Width of the shear wall, in feet (mm)

E_s = Modulus of elasticity of steel = 29,500,000 psi (203,000 MPa)

Gt_{panel} = OSB panel sheathing rigidity through the thickness = 83,500 lbf/in. of panel depth. See Table 2305.2(2) of the IBC.

h = Wall height, in feet (mm)

s = Maximum fastener spacing at panel edge, in inches (mm)

t_{panel} = Nominal panel thickness, in inches (mm)

t_{stud} = Framing designation thickness, in inches (mm)

v = Shear demand (V/2b), in pounds per linear foot (N/mm)

V = Total lateral load applied to the shear wall, in pounds (N)

β = 660 for OSB

ρ = 1.05 for OSB

ω_1 = s/6 (for s in inches), s/152.4 (for s in mm)

ω_2 = $0.033/t_{stud}$ (for t_{stud} in inch) and $0.838/t_{stud}$ (for t_{stud} in mm)

ω_3 = $\sqrt{\frac{h/b}{2}}$

ω_4 = 1 for wood structural panels

δ_v = Vertical deformation of anchorage/attachment details, in inches (mm)

δ = Calculated deflection, in inches (mm)

4.1.2.2 Seismic Resistance: Allowable racking shear loads are given in Table 1 for seismic forces for use with load combinations in IBC Section 1605.3.1. The response modification coefficient, R, the system overstrength factor, Ω_0, and the deflection amplification factor, C_d, must be equal to 3. Shear wall deflection due to the applied shear load must be calculated using the equations given in Section 4.1.2.1.

4.2 Installation:

The Jaaco NailPro hardened ballistic fasteners must be installed using pneumatic or fuel-powered tools recommended by Jaaco Corporation. The fasteners must be installed such that the fasteners' tips pierce the OSB panels being fastened and protrude through the CFS framing members a minimum of $^1/_2$ inch (12.7 mm). OSB panels must be installed with the long dimension perpendicular to the steel stud framing. The fasteners must be installed a minimum of $^1/_2$ inch (12.7 mm) from the edge of OSB panels. The spacing of the fasteners must be a maximum of 6 inches (152 mm) on center in the field of the sheathing panel. The spacing of the fasteners at the panel edges must be a minimum of 2 inches (51 mm) and a maximum of 6 inches (152 mm), as specified by a registered design professional, based on Table 1.

The CFS wall studs must be fastened to the wall tracks, with one No. 10 by $^3/_4$-inch-long (19.1 mm), modified truss head, zinc-coated screw complying with ASTM C1513, through each flange.

4.3 Special Inspection:

Special inspection of the fastening and anchoring of the shear walls described in this evaluation report is required in accordance with 2015 IBC Sections 1705.1.1, 1705.11.2 including Exception 2, and 1705.12.3 including Exception 2 (2012 IBC Sections 1705.1.1, 1705.10.2 including Exception 2 and 1705.11.3 including Exception 2; 2009 IBC Sections 1704.15, 1706.3 including Exception 2 and 1707.4 including Exception 2). A Statement of Special Inspections must be submitted to the code official in accordance with 2015 and 2012 IBC Sections 1704.3 (2009 IBC Section 1705).

5.0 CONDITIONS OF USE

The Jaaco NailPro hardened ballistic fasteners described in this evaluation report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this evaluation report, subject to the following conditions:

5.1 The fasteners must be installed in accordance with the manufacturer's installation instructions and this evaluation report. In the event of a conflict between this report and the manufacturer's installation instructions, the more restrictive requirements govern.

5.2 Other components of the shear wall assemblies must comply with this report, the applicable code and current ICC-ES evaluation reports.

5.3 Shear wall assemblies constructed with Jaaco NailPro fasteners are limited to Seismic Design Categories A and B.

5.4 Installation is limited to structures four stories or less in height with interior walls, partitions, ceilings and exterior wall systems that have been designed to accommodate story drift. Building height must also be limited in accordance with Chapter 5 of the IBC and ASCE 7 Table 12.2-1.

5.5 Calculations demonstrating that the applied in-plane shear loads are less than the available shear wall strength must be submitted to the code official for approval.

5.6 Calculations and details showing that the sheathing, the CFS framing and the foundation anchorage are adequate to resist the applied transverse loads and comply with the applicable provisions in Sections C2 and C5 of AISI S213, must be submitted to the code official. The CFS framing must also be adequate to support the applied gravity loads.

5.7 Calculations and details must be submitted to the code official showing how the lateral loads are transferred from the roof or floor diaphragm into the shear wall.

5.8 When the shear wall assemblies are used in buildings that are more than one story tall, calculations and details must be submitted to the code official showing the load path for transfer of lateral and overturning forces from the upper-story shear walls to the foundation.

5.9 Calculations and details noted in Sections 5.5, 5.6, 5.7 and 5.8 must be signed and sealed by a registered design professional, when required by the statutes of the jurisdiction in which the project is to be constructed.

5.10 Use of the fasteners described in this report is limited to dry locations.

5.11 Use of the fasteners described in this report in contact with preservative-treated or fire-retardant-treated wood members is outside scope of this report.

5.12 Wood structural panels used on weather-exposed surfaces defined in Section 202 of the IBC or Section R703 of the IRC shall be protected by a weather-resistant exterior envelope.

5.13 The fasteners are manufactured under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Power-actuated Fasteners for Shear Wall Assemblies with Cold-formed Steel Framing and Wood Structural Panels (AC230), dated September 2015.

7.0 IDENTIFICATION

7.1 Hardened Ballistic Fasteners:

Each carton and packaging unit of the hardened ballistic fasteners described in this report must be identified by a label bearing the name and address of the report holder (Jaaco Corporation); the product brand name (NailPro) and item number; nominal fastener size and length; coating type; and the ICC-ES evaluation report number (ESR-4194 or ESR-2961). Each fastener head must bear a marking as shown in Figure 1.

7.2 The report holder's contact information is the following:

JAACO CORPORATION
18080 NE 68TH STREET, SUITE C-130
REDMOND, WASHINGTON 98052
(425) 952-4205
www.jaaco.com
jaaco@qwestoffice.net

7.3 Cold-formed Steel Framing:

Each CFS framing member must be identified in accordance with the applicable ICC-ES evaluation report.

7.4 Wood Structural Panels (OSB):

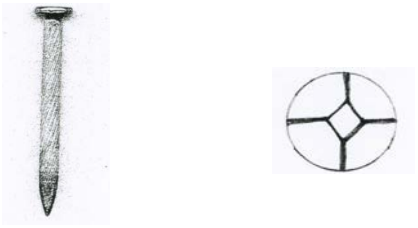
Wood structural panels must be identified in accordance with DOC PS-2.

TABLE 1—ALLOWABLE RACKING SHEAR FOR SHEAR WALLS CONSISTING OF OSB WOOD STRUCTURAL PANELS ATTACHED TO COLD-FORMED STEEL (CFS) FRAMING MEMBERS WITH NAILPRO 1.5-INCH-LONG NP100K FASTENERS[1,2,3,4,5]

WALL SHEATHING (span rating, thickness and type)	MAXIMUM CFS STUD SPACING	FORCE	ALLOWABLE SHEAR (plf): FASTENER SPACING AT PANEL EDGES (in.)			
			6	4	3	2
32/16, $^{15}/_{32}$-inch OSB on one side of CFS stud	24	Seismic (short-term load)	135	135	135	135
		Wind (short-term load)	165	165	165	165

For **SI:** 1 inch = 25.4 mm, 1 lb/ft = 0.0146 N/mm.

[1] The tabulated values are for short-term loading due to wind or seismic forces. For shear loads of normal and permanent load duration as defined by the AF&PA NDS, the tabulated values must be multiplied by 0.63 and 0.56, respectively.
[2] Values may be increased for panels installed on both sides of a wall in accordance with applicable code.
[3] Thicker wood structural panels may be used, but provide no increase in allowable shear loads. The fastener penetration must comply with Section 4.2.
[4] Allowable loads are based upon a safety factor $\Omega = 2.5$ for seismic and $\Omega = 2.0$ for wind in accordance with Section C2.1 of AISI S213.
[5] To obtain LRFD design strength for wind, multiply allowable racking shear for wind by $\Omega = 2.0$ and then multiply by $\phi = 0.65$. To obtain LRFD design strength for seismic, multiply allowable racking shear for seismic by $\Omega = 2.5$ and then multiply by $\phi = 0.60$.



a. Knurled Shank Fastener b. Fastener Head Marking

FIGURE 1—JAACO NAILPRO HARDENED BALLISTIC FASTENERS AND FASTENER HEAD MARK